

Presumed knowledge for mathematics SL and HL

General

Students are not required to be familiar with all the topics listed as presumed knowledge (PK) **before** they start this course. However, they should be familiar with these topics before they take the **examinations**, because questions assume knowledge of them.

Teachers must therefore ensure that any topics designated as presumed knowledge that are unknown to their students at the start of the course are included at an early stage. They should also take into account the existing mathematical knowledge of their students to design an appropriate course of study for mathematics SL or mathematics HL.

This list of topics is not designed to represent the outline of a course that might lead to the mathematics SL or mathematics HL course. Instead, it lists the knowledge, together with the syllabus content, that is essential to successful completion of the mathematics SL or mathematics HL course.

Students must be familiar with SI (*Système International*) units of length, mass and time, and their derived units.

Topics

Number and algebra

Routine use of addition, subtraction, multiplication and division using integers, decimals and fractions, including order of operations.

Example: $2(3 + 4 \times 7) = 62$.

Simple positive exponents.

Examples: $2^3 = 8$; $(-3)^3 = -27$; $(-2)^4 = 16$.

Simplification of expressions involving roots (surds or radicals).

Examples: $\sqrt{27} + \sqrt{75} = 8\sqrt{3}$; $\sqrt{3} \times \sqrt{5} = \sqrt{15}$.

Prime numbers and factors, including greatest common factors and least common multiples.

Simple applications of ratio, percentage and proportion, linked to similarity.

Definition and elementary treatment of absolute value (modulus), $|a|$.

Rounding, decimal approximations and significant figures, including appreciation of errors.

Expression of numbers in standard form (scientific notation), that is, $a \times 10^k$, $1 \leq a < 10$, $k \in \mathbb{Z}$.

Concept and notation of sets, elements, universal (reference) set, empty (null) set, complement, subset, equality of sets, disjoint sets. Operations on sets: union and intersection. Commutative, associative and distributive properties. Venn diagrams.

Number systems: natural numbers; integers, \mathbb{Z} ; rationals, \mathbb{Q} , and irrationals; real numbers, \mathbb{R} .

Intervals on the real number line using set notation and using inequalities. Expressing the solution set of a linear inequality on the number line and in set notation.

The concept of a relation between the elements of one set and between the elements of one set and those of another set. Mappings of the elements of one set onto or into another, or the same, set. Illustration by means of tables, diagrams and graphs.

Basic manipulation of simple algebraic expressions involving factorization and expansion.

Examples: $ab + ac = a(b + c)$; $(a \pm b)^2 = a^2 + b^2 \pm 2ab$; $a^2 - b^2 = (a - b)(a + b)$;

$3x^2 + 5x + 2 = (3x + 2)(x + 1)$; $xa - 2a + xb - 2b = (x - 2)(a + b)$.

Rearrangement, evaluation and combination of simple formulae. Examples from other subject areas, particularly the sciences, should be included.

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The linear function $x \mapsto ax + b$ and its graph, gradient and y-intercept.

Addition and subtraction of algebraic fractions with denominators of the form $ax + b$.

Example: $\frac{2x}{3x-1} + \frac{3x+1}{2x+4}$.

The properties of order relations: $<$, $=$, $>$, \neq .

Examples: $a > b, c > 0 \Rightarrow ac > bc$; $a > b, c < 0 \Rightarrow ac < bc$.

Solution of equations and inequalities in one variable, including cases with rational coefficients.

Example: $\frac{3}{7} - \frac{2x}{5} = \frac{1}{2}(1-x) \Rightarrow x = \frac{5}{7}$.

Solution of simultaneous equations in two variables.

Geometry

Elementary geometry of the plane including the concepts of dimension for point, line, plane and space. Parallel and perpendicular lines, including $m_1 = m_2$, and $m_1 m_2 = -1$. Geometry of simple plane figures. The function $x \mapsto ax + b$: its graph, gradient and y-intercept.

Angle measurement in degrees. Compass directions and bearings. Right-angle trigonometry. Simple applications for solving triangles.

Pythagoras' theorem and its converse.

The Cartesian plane: ordered pairs (x, y) , origin, axes. Mid-point of a line segment and distance between two points in the Cartesian plane.

Simple geometric transformations: translation, reflection, rotation, enlargement. Congruence and similarity, including the concept of scale factor of an enlargement.

The circle, its centre and radius, area and circumference. The terms "arc", "sector", "chord", "tangent" and "segment".

Perimeter and area of plane figures. Triangles and quadrilaterals, including parallelograms, rhombuses, rectangles, squares, kites and trapeziums (trapezoids); compound shapes.

Statistics

Descriptive statistics: collection of raw data, display of data in pictorial and diagrammatic forms (for example, pie charts, pictograms, stem and leaf diagrams, bar graphs and line graphs).

Calculation of simple statistics from discrete data, including mean, median and mode.